# Carbon America: Providing Regional Carbon Emissions and Uptake Information for Carbon Management

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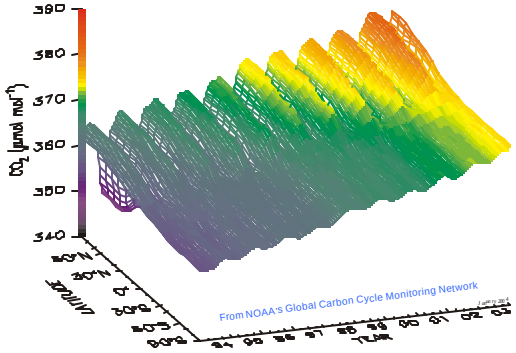
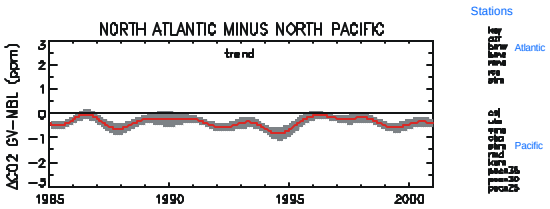
**The smaller than expected North - South gradient of atmospheric $CO_2$, combined with data on the partial pressure of $CO_2$ in ocean surface waters, suggested that there is a large terrestrial $CO_2$ sink at temperate latitudes in the Northern Hemisphere – Tans et al, 1990 (*U.S. Carbon Cycle Science Plan, USGCRP, 1999*)**



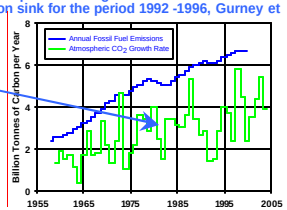

**Carbon Dioxide levels off the east coast of the U.S. are consistently lower than off the west coast. If the U.S is a large $CO_2$ producer why isn't it the opposite?**




- **Is there a large sink for $CO_2$ in the North Atlantic?**
- **Is $CO_2$ escaping the U.S. into Canada or Mexico?**
- **Is there a large sink for $CO_2$ in North America?**

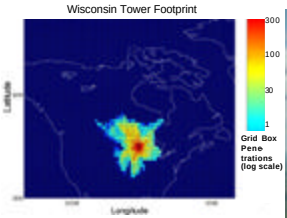
## Why North America ?

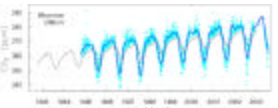
- **1990** – A major $CO_2$ sink is discovered in the Northern Hemisphere from global $CO_2$ measurements, Tans et al., *Science 247*, 1431-1438.
- **1995** – The Northern Hemisphere sink is established as being mainly "terrestrial" in nature from isotopic carbon measurements, Ciais et al., *Science, 269*, 1098-1102.
- **1998** – A large terrestrial $CO_2$ sink in North America is implied by $CO_2$ data and inverse transport models, Fan et al., *Science 282*, 442-446.
- **2002** – The average of 16 inverse transport models give a value of 0.9 ± 0.6 GtC/yr for the North American carbon sink for the period 1992 -1996, Gurney et al., *Nature, 415*, 626-630.
- **1958-2004** – The large degree of interannual variability observed in the atmospheric $CO_2$ growth rate over this period is likely related to terrestrial biospheric processes.



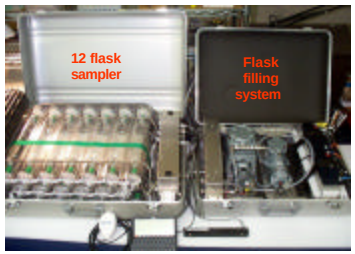

**Carbon America is an element of NOAA's Carbon Cycle Atmospheric Observing System and is focused on North America in order to determine carbon dioxide emission (sources) and uptake (sinks) in and around the U.S. The observing system consists of automated gas sampling systems flown on small chartered aircraft and instrumentation measuring from several heights on very tall (~ 500 m) communication towers. This program is a key element of the interagency North American Carbon Program (NACP), involving research by NOAA and six other agencies. NACP is aimed at understanding the carbon balance of North America and determining regional geographic sources and sinks of carbon dioxide, methane and carbon monoxide and how the y change. CCSP Synthesis and Assessment Product 2.2 is concerned with the North American carbon budget. Carbon America will be instrumental in providing data in this regard.**

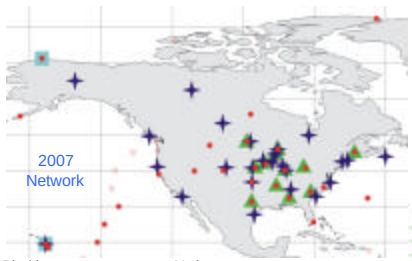
## Monitoring $CO_2$ From Tall (~ 500 m) Towers

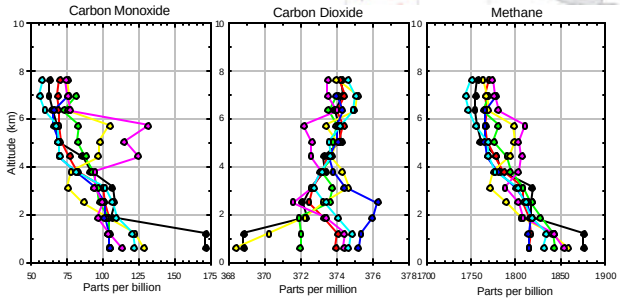




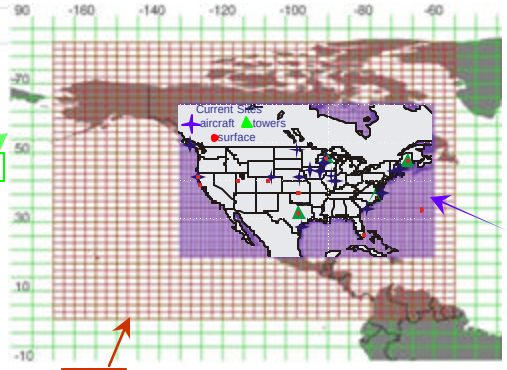



Vertical Profiles of CO, $CO_2$, and $CH_4$ at a number of sites in IA, IL, NE, ND and WI during September 13-21, 2004

## Using the Data for Source and Sink Determinations: Inverse Transport Model Nested Grids



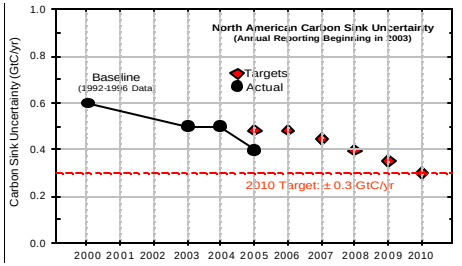

North American Carbon Program
Interagency Collaboration

- Atmospheric concentrations ($CO_2$, CO, $CH_4$)[1]
- Dissolved $CO_2$ & other species in adjacent ocean basins and coastal margins[1,6,7]
- Ecosystem fluxes, integrated with process studies[2,7]
- Land use/management history[3,4,5]
- Inventories of carbon stocks[3,5]
- Remote sensing[1,6]
- Terrestrial vegetation models[6,7]
- Emission inventories[2,8]
- 4-D data assimilation and inverse modeling[1,6]

**2002**

1. NOAA 2. DOE 3. USDA 4. USGS 5. USFS 6. NASA 7. NSF 8. EPA

GPRA Performance Measure




**Conclusion: With the addition of new aircraft stations in the US. midwest, the uncertainty in the North American carbon uptake has been reduced from about 0.5 billion tons of carbon per year (GtC/yr) to about 0.4 GtC/yr. The goal of 0.3 GtC/yr will allow for regional determination of carbon dioxide emissions and uptake which will be useful for carbon management, sequestration activities and future carbon credits.**